Biological Opinion on the Klamath Hydroelectric Settlement Agreement and accompanying EIS

External Independent Peer Review by the Center for Independent Experts

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Executive Summary

Through the Center of Independent Experts, Dr. Steven Cooke was contracted to evaluate the Joint Biological and Conference Opinion on the Proposed Removal of Four Dams on the Klamath River. The Draft Biological and Conference Opinion (herein DBO) was conducted by the National Marine Fisheries Service (Southwest Region) and the United States Fish and Wildlife Service (Region 8). Dr. Cooke was asked to review the strengths and weaknesses of the DBO. The DBO focused largely on coho salmon with additional information on eulachon, killer whales, steller sea lions, and Chinook salmon. For the coho salmon populations in the Klamath Basin, the DBO identified that there would indeed be a variety of impairments for multiple stocks and life-stages. However, the majority of the impairments (largely related to suspended sediment effects on both coho and coho habitat) were short-lived with the belief that in the long-term (i.e., ~2+ yrs after dam removal) there would be benefits. The evaluation of potential impacts of glyphosate herbicide impacts failed to provide any justification for the need of the herbicide in the first place. The application of herbicide seems to be one of the few aspects of the dam removal process for which it is not an unavoidable consequences (compared to something like concrete dust or sediment mobilization). As such, I was surprised that the DBO did not suggest the consideration of alternatives. Although it is unlikely that glyphosate would be detrimental, it seems to me that this risk could be entirely avoided. The DBO also incorporated the potential role of climate change in the analyses. The science reviewed represented a combination of primary peer-reviewed literature and government and industry technical reports. The DBO used the viable salmonid population framework and incorporated a variety of modeling tools. Given the extensive intra-specific variation in coho populations, it would have been desirable to have population-specific thresholds for water temperature and suspended sediments. There was significantly less information available for the eulachon component of the analysis. For example, there is no information on eulachon responses to suspended sediment and even basic information on run sizes is somewhat suspect making inferences difficult. The analysis of the potential consequences of the action on Chinook salmon and the subsequent impacts on killer whales is lengthy and it is acknowledged that there are many unknowns, particularly related to the overlap in distribution of killer whales and Klamath Chinook and the reliance on killer whales on Chinook from that system. The DBO concludes that there would be a relatively small reduction in Chinook as a prey item for killer whales in the short term (~4 yrs), again assuming that killer whales actually consume fish from the Klamath. The DBO related to Steller sea lions is similar to that of killer whales (i.e., salmon prey resources unlikely to be affected in an appreciable manner), and consistent with a previous biological assessment conducted by other agencies. The DBO is cautious in its interpretation in instances where there were shortcomings with available data and was also quite transparent regarding the many assumptions. Nonetheless, the DBO does represent a review of what I believe is the best scientific information available. The document itself is somewhat cumbersome especially given

that information on some species was provided as a separate document and in other cases there was brief mention of some species and then they were mysteriously omitted from the rest of the DBO. Some elements were repetitive, particularly for the coho salmon content. The discussion of Chinook salmon as it relates to killer whale populations rambled (told almost as a narrative) but did present a series of logical arguments that collectively led to the DBO conclusion. I have provided rather extensive comments on the DBO, but my overall impression is that the document (considering both documents as a single unit) is thorough and the conclusions consistent with the best available science. It is clear that much thoughtful and careful analysis and reasoned interpretation served as the basis for the DBO.

Background

Pursuant to the National Environmental Policy Act (NEPA), an Environmental Impact Statement (EIS) is being developed to consider whether to remove four dams on the mainstem Klamath River pursuant to the terms of the Klamath Hydroelectric Settlement Agreement (KHSA). This proposal would constitute the largest dam removal restoration action in United States history. Conflicts over water and other natural resources in the Klamath Basin between conservationists, tribes, farmers, fishers, and State and Federal agencies have existed for decades. Since 2003, the United States has spent over $500 million in the Klamath Basin for irrigation, fisheries, National Wildlife Refuges, and other resource enhancements and management actions. Consequently, the United States, the States of California and Oregon, the Klamath, Karuk, and Yurok Tribes, Klamath Project Water Users, and other Klamath River Basin stakeholders negotiated the Klamath Basin Restoration Agreement (KBRA) and the KHSA to resolve long-standing disputes between them regarding a broad range of natural resource issues. Removal of the four dam facilities would provide for a free-flowing river and would optimize the efficiency of fish migration to and from the Upper Basin as well as through the entire Hydroelectric Reach. The entire river from Keno Dam to the Pacific Ocean would become a connected, free-flowing river and would provide anadromous fish habitat in the reach currently upstream of IGD that has not been available for nearly a century. Given the massive scope of the project, it has large potential implications on the economy of California and Oregon, commercial, tribal and recreational fisheries in California and Oregon, and tribal and public trust resources.

The U.S. Fish and Wildlife Service and National Marine Fisheries Service jointly prepared a biological opinion based on their review of the proposed Removal of Four Dams on the Klamath River for the Bureau of Reclamation (Reclamation), Jackson, Lake, and Klamath Counties in Oregon, and Siskiyou, Modoc, Trinity, Humboldt and Del Norte Counties in California. Detailed aspects of the consultation process are provided in the biological opinion document. The process also relies on independent experts to provide peer review of the biological opinion. To that end the Center for Independent Experts (CIE) facilitated an external review for with Dr. Steven Cooke was one of the independent contractors (see next section for details on the role of Dr. Cooke in the review process). This document represents the independent review prepared for the CIE by Dr. Steven Cooke (Carleton University, Ottawa, Canada).

Role in the Review Activities

Through the Center of Independent Experts, Dr. Steven Cooke was contracted to evaluate the Joint Biological and Conference Opinion on the Proposed Removal of Four Dams on the Klamath River. Dr. Cooke is a Canada Research Chair and Associate Professor at Carleton University in Ottawa, Canada. Cooke has experience in fish migration, Pacific salmon ecology, conservation science, aquatic ecology, physiological ecology, and natural resources management as demonstrated by over 245 peer reviewed publications. Dr. Cooke has not worked in the Klamath Basin but is familiar with pertinent literature and issues. However, Dr. Cooke has no knowledge of the relevant heavy machinery needs for dam removal or the off-site waste disposal needs for the various materials. The Draft Biological and Conference Opinion was conducted by the National Marine Fisheries Service (Southwest Region) and the United States Fish and Wildlife Service (Region 8). The documents were provided to Dr. Cooke on December 16, 2011. Dr. Cooke first read the biological opinion and related documents (outlined in Appendix 1) and then conducted a review in accordance with the terms of reference for the review (outlined in Appendix 2). In particular, Dr. Cooke was asked to consider the following points and present them in this document in terms of strengths and weaknesses.

1. Are the assumptions and the effects conclusions in the biological opinion scientifically reasonable/supportable and logical, especially pertaining to the suspended sediment analysis?

2. Is the herbicide effects analysis in the draft biological opinion scientifically reasonable/supportable and logical?

3. Are the critical habitat and coho salmon effects analysis comprehensive?

4. Are there any missing critical assumptions and effects to fish and habitat (coho, eulachon, green sturgeon) that should be in the draft biological opinion?

5. What sections of the draft biological opinion need to be improved, and any recommendations on how?

6. Does the biological opinion represent the best scientific information available?

Given the focus on the above questions, the summary of findings (below) are presented in that order but prefaced with a general overview. In addition, wherever opportunities for change or improvement are noted (at least substantial ones), I note such by listing a short "RECOMMENDATION". The entire list of recommendations is then presented at the end of the document.

Summary of Findings for each ToR

General Comments (not all of these are directly related to the ToR but do reflect my overall impression of the DBO)

- The document was generally difficult to follow, perhaps owing to my lack of familiarity with the government process. Nonetheless, the need to refer to a separate document (the marine mammal text) makes the entire DBO cumbersome. Moreover, the reader had the impression that bull trout, suckers, etc. would also be included (they are in the table of contents and in section 1.3 but it refers to "From FWS") but not sure where they fit in. There are a few pages on green sturgeon but nothing at all on bull trout or the suckers. On page 42 it is mentioned that "…the opinion analyzes…. on green sturgeon…" yet there is no analysis. I read and re-read the introductory materials and these passages in an attempt to decipher what and why they were excluded and it was never clear to me. A clear and simple rationale for the structure of the document would be useful. Likewise, if certain species are not discussed in the DBO, then remove them from the table of contents or provide clarity regarding their exclusion/inclusion.
- The document on killer whales and steller sea lions is presented more as a narrative and therefore in a different format than the larger document on coho salmon. In some ways I found these discussions easier to follow perhaps given that it was not jumping between multiple species analyses (e.g., in the main DBO document there is discussion of coho and eulachon throughout). I am not sure if the inconsistency is problematic but I did want to acknowledge the inconsistency.
- In reading the draft biological opinion (herein called DBO), it strikes me that in some ways this is a life cycle assessment (think cradle to grave) for dams. This is not a criticism or a suggestion – just an observation.

RECOMMENDATION – Integrate the DBO components from the marine mammal analysis into the main DBO.

RECOMMENDATION – Consider reorganizing DBO to improve clarity and to reduce repetition.

RECOMMENDATION – Clarify why there is little if any discussion of green sturgeon.

Question 1. Are the assumptions and the effects conclusions in the biological opinion scientifically reasonable/supportable and logical, especially pertaining to the suspended sediment analysis?

Sediment consequences (direct and indirect) probably represent the largest potential risk associated with the proposed action. As such, much of the document is devoted to the topic.

Indeed, the topic is related to most of the other questions posed as part of the TOR. As such, here I briefly focus on several key issues related to the suspended sediment analysis but refer the reader to other questions as well (especially Questions 5 for which I provided extensive commentary on the document).

Page 37 to 39 – The section on suspended sediment is particularly clear. There is ample discussion of the basis for the model inputs and recognized the limitations (e.g., the model exaggerates the negative effects of low levels of sediment). There are nonetheless some limitations with that dataset as there are few comparative analyses that examine species- or population-specific variation in how salmonids will respond to sediment. The review on which the DBO sediment discussion is largely based (i.e., Newcombe, C.P. and J.O.T Jensen, 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. N. Am. J. Fish. Manag. 16: 693–727.) provides many generalizations and is not even specific to salmonids.

On page 165 when discussing the "effects" of the action, it is noted that there is no information on the effects of suspended sediment on eulachon which represents a major weakness. The same model used for salmonids (Newcomb and Jensen) was thus applied to eulachon which of course has limitations. Throughout this section (especially on page 166) the DBO is cautious on the inferences made from the data used (including information on eulachon run sizes) to form their opinion.

The DBO states that "…After reviewing the current status of the SONCC coho salmon, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the NMFS's[1] biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the SONCC coho salmon, and is not likely to destroy or adversely modify critical habitat for the SONCC coho salmon." A similar opinion is stated for eulachon. The DBO goes on to note that some adverse effects are anticipated but they are believed to be short lived. Of all the possible adverse effects, the one that seems to be least predictable deals with suspended sediment and bedload that will be mobilized with dam removal. Although there are modeling projections, the actual movement of sediment will depend on complex hydraulic processes driven by climate and channel form. It is indeed likely that the majority of the effects will be short-lived but I think that the sediment issue could result in long-lasting consequences or have greater downstream (i.e., estuarine) impacts. I am not a hydraulic engineer but I would suggest that the sediment component of the DBO requires additional evaluation by independent experts with knowledge of sediment dynamics.

Question 2. Is the herbicide effects analysis in the draft biological opinion scientifically reasonable/supportable and logical?

[1] A minor comment: What is the US Fish and Wildlife Service's role in the biological opinion?

Potential toxicity from glyphosate use to control weeds in the reservoir areas; The DBO contains significant discussion of glyphosate (some context is provided on page 20). In the DBO it states that "The restoration of the four reservoir areas would establish herbaceous vegetation. However, herbicides would be required to control noxious weeds in the first year following dam removal and potentially the second year. Herbicide application, namely glyphosate, may be required for 25 to 75% of the total reservoir area (O'Meara et al. 2010)." The DBO concludes that the use of glyphosate in the manner proposed would be proposed glyphosate application is not likely to adversely affect coho salmon. The DBO covers both lethal and sublethal effects. Given that this potential stressors are complex (it requires 3 pages to attempt to demonstrate that the effects would be negligible), I am somewhat surprised that there is no encouragement to explore alternative measures. I am not sure whether this is something within the scope of "my" duties but there was insufficient information in the DBO to justify the need for glyphosate in the first place. Is its use really necessary? I can't imagine that the goal is to establish a manicured lawn free of weeds but rather to establish a variety of native plants and trees that will stabilize sediment and create a meaningful riparian plant community. The term "weeds" seems inappropriate (unless we are talking about invasive weed species – which apparently do exist in the area – see page 20) – there will certainly be a variety of early colonizers that will represent a range of plant species with different roles in riparia. Essentially, I wonder if this entire risk could be mitigated by using alternatives. I am surprised that the DBO does not include such discussion or commentary. On page 20 it is acknowledged that it would only be used if needed but I think that very careful thought is required re the triggers that would lead to its use and who would ultimately control the application. In practice the BMPs presented should minimize risk but they will not eliminate it.

Regarding 6.1 – Effects of the action > Stressors (Stressor 5 – potential effects on adult spawners) - Why are the trade-offs not discussed for other stressors – e.g., - the use of glyphosate herbicides… what are the real benefits of using it to justify the risk, even if they are apparently "dismissible"?

RECOMMENDATION – Revisit the glyphosate analysis at a higher level to consider on what basis it will be used and if the benefits from its use justify the potential risks.

Question 3. Are the critical habitat and coho salmon effects analysis comprehensive?

The effects analysis for coho (discussed below in Question 5 in detail) is lengthy and comprehensive. The DBO uses the VSP concept to evaluate the potential consequences of the action. The complexity of the SONCC coho salmon story is probably one of the reasons why I found the document itself to be a challenge to navigate. Being unfamiliar with the basin but cognizant of the life-history variation (intra-specific) that exists in Pacific salmonid species I recognize the many subtleties and need for such a lengthy and nuanced analysis. The VSP concept provides a quantitative benchmark. Of course, the analyses require modeling

approaches which are subject to a variety of biases and errors. Williams et al. (2008) provides a detailed framework which serves as the basis for the DBO.

Question 4. Are there any missing critical assumptions and effects to fish and habitat (coho, eulachon, green sturgeon) that should be in the draft biological opinion?

Table 12 provides a concise and transparent overview of some key assumptions made to address uncertainties. Such a table is important, although I think it would be worthwhile to have a table (or expand this one) that better recognizes the broader suite of limitations or assumptions inherent in other aspects of the DBO. There is far less information on green sturgeon (almost as if it were accidentally omitted).

RECOMMENDATION – Expand (Table 12) or create additional tables that outline the limitations and assumptions in all aspects of the DBO (especially the sections dealing with marine mammals).

Question 5. What sections of the draft biological opinion need to be improved, and any recommendations on how?

Following the general outline of the document(s), I provide a series of comments on key components of the DBO.

Within the range of the SONCC coho salmon ESU, the DBO describes life cycle of the species into five essential habitat types: (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. These habitat types are reasonable and each are discussed at length. On page 70 it is noted that "Some streams in the ESU remain somewhat intact relative to their historical condition, but the majority of the waterways in the ESU fail to provide sufficient juvenile summer and winter rearing areas". That finding emphasizes that efforts to remove dams must be supported by parallel efforts to restore/create appropriate habitats for all life-stages beyond simply reconnecting habitats.

The eulachon section is not nearly as extensive as that of coho but is nonetheless, quite comprehensive. The threats relate largely to habitat loss/degradation, commercial fisheries and climate change. Section 5 for eulachon (starting on page 129) briefly summarizes the current status.

Section on seasonal baselines - I found this section to be rather complete. At times it was overly speculative (e.g., the section on parasites/disease is based on speculation or at best associations rather than actual confirmed cause and effect relationships – see Pages 90-93). These same issues are rehashed on pages 124 to 128 (although here some data from the action area is presented). The separate document by Bartholomew and Foott (2010) provided as reference

material for the DBO provides more information on disease and parasites and does so in a less speculative manner (or at least one can appreciate the details on what is and is not known).

Section 5.3.4 (page 107) – This is the first focused discussion on the factors affecting coho salmon and their habitat in the actual "action" area. On page 109 there is some discussion about historical hydrographs and challenges in inferring "unimpaired" conditions. That is a real challenge! The dataset used is probably the best available and the limitations seem to be acknowledged. This section (on coho in the action area) continues through to page 129. There are many redundancies with the earlier sections that were more broadly focused on the entire basin or the SONCC footprint. I can understand the need for having detailed information but this is all really just background and is not really the BO per se (in my "opinion"). This structure (of repetition at different scales) is probably the most irritating in the context of the speculative parts where we see the speculation play out over multiple scales (again drawing attention to the disease section – see my comments above).

RECOMMENDATION – Attempt to reduce speculation, particularly related to disease. There are other parallel documents that discuss (and speculate) upon disease aspects but I don't see them as being essential to the DBO.

6.1 – Effects of the action > Stressors – Here I comment on the DBO evaluation of the potential stressors associated with the action. I consider this section to be a critical component of the DBO. Note that 3 (sediment) and 5 (potential reduction in habitat – a few comments on glyphosate) are discussed respectively under question 1 and 2 above.

1. Potential toxicity from chemical spills; The DBO concludes that chemical spill effects to listed species and critical habitat in the action area are expected to be discountable based on a variety of relevant BMPs (as outlined on page 132). I concur with this assessment and agree that the likelihood of exposure is discountable (using the DBO terminology). It is worth noting that in practice adherence to these BMPs will require careful monitoring of contractors.

RECOMMENDATION – The DBO should emphasize the importance of monitoring and compliance for all BMPs proposed for the action area.

2. Potential pH increases from concrete dust. The DBO concludes that the effects of concrete dust to listed species and their critical habitat in the action area are expected to be discountable. I concur with this assessment (especially related to pH). However, the DBO is rather focused on the pH effects rather than the physical aspects of concrete dust (e.g., on elevating suspended solids). I presume that the physical effects have been considered?

4. Potential injury or mortality from blasting and associated demolition activities, it was unclear where this was discussed…

5. Potential reduction in spawning habitat. Note that on bottom of page 135 the DBO states "x miles" – need the "real" number! There has apparently been a variety of recent modeling exercises and the information reported in the DBO suggests that there would be an effect but it would be shortlived. Here there is also discussion of a trade-off – i.e., although there is a short term effect but there are long term benefits.

6. Potential reduction in rearing habitat (e.g., substrate and space, food resources, water temperature, and dissolved oxygen); this section of the DBO requires a synthesis!

RECOMMENDATION – Provide a concise synthesis for Section 6, stressor 6 (i.e., potential reduction in rearing habitat).

7. Potential reduction in migration habitat. The DBO suggests that there will be a temporary migration impediment associated with dam removal. Although not a physical barrier, the sediment may lead to delayed or failed migration. It was unclear what if any BMPs could be used in an attempt to mitigate this effect. Could adult salmon be trapped and transported above the sediment impediment?

8. Increase in suspended sediment concentrations from reservoir drawdown and inwater construction activities;

9. Potential injury or mortality from cofferdams construction and demolition activities. Regarding threat 2 above – I guess this is where the physical aspects of concrete dust are discussed. Is there more information on the "small number" of coho spawners that would be affected by coffer dam construction in January? Those late spawners may provide an important diversity component. Are there mitigative actions that could be taken to reduce solid inputs arising from blasting and coffer dam?

10. Potential injury or mortality from spawner relocation activities. On page 157 there is discussion of the potential consequences of different capture techniques including seine nets and electrofishing. The electrofishing section is well-referenced but the seine net section is not (which is fair given that until very recently there was no such empirical data for coho – see new paper by Raby et al. - Raby, G.D., M.R. Donaldson, S.G. Hinch, D.A. Patterson, A.G. Lotto, D. Robichaud, K.K. English, W.G. Willmore, A.P. Farrell, M.W. Davis, and S.J. Cooke. In Press. Validation of reflex indicators for measuring vitality and predicting the delayed mortality of wild coho salmon bycatch released from fishing gears. Journal of Applied Ecology DOI:10.1111/j.1365-2664.2011.02073.x)

I concur with the assessment that there will be some level of stress and injury associated with capture and transport of adults but the protocols (BMPs) for handling adult salmonids are well established and professional fisheries biologists with experience in handling coho would significantly reduce negative consequences to the fish.

11. Potential injury or mortality from juvenile fish relocation activities. On page 158 it is stated that "Capture operations would only occur if SSC measured in the mainstem were at levels exceeding Newcombe and Jensen (1996) SEV levels of 8." It would seem to me that there is time to use relevant coho juveniles from this system and conduct an experiment to determine if the SEV level 8 threshold is low or high for this species/population.

RECOMMENDATION – If time permits, conduct empirical studies using various stocks of Klamath coho salmon and various life cycles to identify their sensitivity and thresholds to various concentrations of suspended sediment. The same should also be done for eulachon given that there have been no such studies on that species.

Benefits – In general, I was surprised that the list of benefits was as short as it was. Perhaps that is due to the focus on coho. However, there are many higher level benefits not discussed here such as the ecosystem services provided by increased access and presumably population sizes of coho salmon. Perhaps the focus on these four benefits is due to their occurrence within the "action area". Other benefits not covered here (at least directly) could include reductions in upstream passage delay associated with dams, reductions in mortality of out-migrating juveniles at hydrofacilities, system level effects related to changes in the combination of physio-chemical and geomorphological characteristics and what they could collectively mean to other trophic levels, presumably increases in population size, etc.

RECOMMENDATION – Consider the system-level benefits (extending beyond fish to the many ecosystem services provided by fish) rather than just the direct benefits on fish.

1. Increased flow variability – I agree that this is one of the major presumed benefits in that the flow should be more variable (which is good for fluvial geomorphological processes).
2. Decreased disease – Like above, I felt that this section on disease was speculative. The lack of historical information on disease and recent innovations in disease surveillance make it difficult to infer historical conditions and thus potential benefit. I do not mean to downplay the importance of disease but I feel that the disease issue and potential benefits of dam removal in this context are very difficult to predict. That said, in the face of climate change, which typically exacerbates disease, any efforts to reduce disease potential (including some of the POSSIBLE benefits that could arise from dam removal) should be promoted.
3. Changes to water temperature – As discussed earlier in the DBO, water temperature is the "master factor" in the lives of fish. Water temperature along with other cues also interact with the endocrine system of fish to influence timing of important activities such as smoltification and upriver migration. To that end, the changes in water temperature in the action area likely represent benefit to the coho. The thermal "benefits" are not straight forward in that there is a general assumption that cold is always better for salmonids. In the case of the DBO, the authors rightfully acknowledge that water

temperature increases (during two periods) will benefit the coho. The thermal modeling work is quite reliable so I concur with the proposed benefits.

4. Restored access to historic habitat – This is clearly one of the major benefits in that connectivity is essential to Pacific salmon life history. The access to thermal refugia is an added benefit.

Regarding the finding that SONCC coho salmon ESU is not viable and at high risk of extinction based on population size (page 52) and viability summary (page 55). In order to determine the status and trend of SONCC coho salmon ESU the DBO used population extinction risk criteria (see Table 13) and the concept of a Viable Salmonid Population (McElhany et al. 2000). For the purpose of the report, they define a viable salmonid population as one that has a low risk of extinction over 100 years and are described in terms of four parameters: abundance, population productivity, spatial structure, and diversity. The conclusion that the SONCC coho salmon ESU is not viable and at high risk of extinction seems to be consistently and overwhelmingly supported by the analysis in the DBO. This is particularly the case for abundance (page 52) but that conclusion is extended in the synthesis (i.e., viability summary; Table 14). There is significant text and graphical elements put forth to support this position. When the viability summary is analyzed for independent populations, as many as 24 out of 30 independent populations are at high risk of extinction and 6 are at moderate risk of extinction. I have full confidence in this classification. On page 98 it is further stated that "generally speaking, none of the nine population units of coho salmon affected by the Proposed Action are considered viable". The disparity in numbers (i.e., discussion of 9 populations vs. 30 above) reflects the fact that the 9 populations are only those that are in the Klamath mainstem or relevant tributaries rather than the broader SONCC. Between page 100 and 103 additional detailed descriptions are provided regarding the status of the various populations. It is fair to say that the DBO has exhaustively and repeatedly demonstrated that the SONCC populations (including those in the Klamath) are not doing well and are at high risk of extinction.

The DBO then goes on further to discuss the factors that both led to the decline and those responsible for the current state. It is clear that the causes are multifactorial as is the case with nearly all population declines.

Section 7 – Cumulative effects – This section is prefaced with the following text "Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the Proposed Action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA." Although these qualifiers are necessary, it seems equally important to define what is meant by cumulative effects in the context of the DBO. Earlier in the DBO there is mention of the term cumulative effects in a "NEPA sense of the term" (NOTE – Unsure what that means). The text at the top of page 42 further explores the concept of cumulative effects (at times called cumulative impacts). The various "government" definitions and subtleties certainly complicate the discussion. Section 7 should begin with a

concise (and referenced) working definition of "cumulative effects". Section 7 itself seems random and out of place. I read it three times and do not understand how it fits into the bigger DBO or how it justifies an entire section unto itself. Rather than a discussion of cumulative effects, the text is focused largely on climate change.

RECOMMENDATION – Section 7 on cumulative effects should be revised to start with a working definition of "cumulative effects" and it should attempt to better connect to the rest of the document rather than dwelling on climate change.

Section 8 – Conclusions

Page 171 – 6th line from the top of page – empty brackets require a reference

Section 9 – Essential Fish Habitat – As above, sediment dynamics (pool filling, alteration to estuary, suspended sediment) likely represent the most significant potential threat associated with dam removal. For migratory habitat of salmon, the EFH discussion concludes that "SSC within the mainstem Klamath River would be high enough to cause moderate to major physiological stress and impaired homing during the fall of 2019 and 2020. Therefore, the Proposed Action may have a substantial adverse effect on coho salmon migration habitat in 2019 and 2020." That perspective is consistent with the material covered in section 6 (the action of stressors). For fall run Chinook "… the short-term Proposed Action may have an adverse effect on migration habitat quality downstream of IGD during the fall of 2020. These effects are expected to be substantial in the short-term, but return to background levels with a few years." No adverse effect is expected for spring Chinook salmon. The basis for these conclusions is as sound as possible without having stock and species-specific information on SSC thresholds from this system.

With respect to spawning habitat, the action would substantially degrade spawning habitat quality in the reach for several years so the DBO concludes that the Proposed Action would have a substantial adverse effect on fall-run Chinook salmon spawning habitat. No effect is anticipated for the spring-run Chinooks. Coho spawning is limited in the mainsteam so due to the low number of redds that could be affected, the DBO states that the Proposed Action would have a more than minimal, but less than substantial adverse effect on coho salmon spawning habitat downstream of IGD. These conclusions also appear sound presuming that the knowledge of spawning sites and migratory behaviour is correct. It appears that there have been a number of telemetry studies (not to mention many years of field surveys) that have provided information to support the DBO.

The largest effects appear to be on incubation habitat where the DBO states that the Proposed Action would have a substantial adverse effect on incubation habitat for fall-run Chinook salmon below IGD for up to 10 years and also for coho but for an unidentified period. The loss of interstitial spaces and increased levels of embeddedness pose risks that could extend for longer periods. Although there are some modeling exercises, it is unclear if there have ever been studies at this scale (spatial, temporal) and magnitude (sheer amount of sediment released) to validate models.

Fry rearing habitats are suggested to be impacted but not to the same extent as incubation habitat. That assessment is also supported by the available data.

Short term impacts on smolt migration are likely to be rather severe (for type 3 chinook a worst case scenario is 100% mortality – although the reality is that this worst case scenario could play out for all species/populations). There are long term benefits but the question is "how long until those benefits are seen". The short-term impacts are predicted to last for several years but again this is a huge "experiment". Despite modeling exercises, the interplay between hydrology, climate (flows), and sedimentary processes, etc., will influence the duration of the apparent "short term" effects. NOTE – I would think that this interplay should be the focus of the sections on cumulative effects.

The conclusion re salmon (Chinook and coho) in the DBO is that the Proposed Action will result in substantial adverse effects on EFH conditions for adult migration, spawning, egg to fry survival, juvenile rearing, and smolt migration downstream of IGD. The Proposed Action will result in more than minimal, but less than substantial, effects on estuarine rearing for Chinook salmon and coho salmon. I concur with those findings and as noted above, but I question the duration of the "short term" effects. The trade-off between short- and long-term effects are difficult to reconcile given the unknowns (projections) regarding how long the SSCs will persist at detrimental levels (both in the water column and as a component of the bedload).

The groundfish DBO is put into context with historical information on sediment inputs into the estuary. The pelagics DBO is also appropriate.

The second document (covering killer whales and steller sea lions) provided relevant background on the natural history of these organisms and their potential interaction with the areas near the action (in marine waters). In addition, the role of salmon as a prey item is discussed relative to the impacts of the action on salmon and the potential subsequent effects on marine mammals. Based on some analyses (a variety of background provided from other documents such as the Bureau of Reclamation biological assessment; BA) it is stated that "As a result, the BA concluded that a reduction in the amount of Klamath Chinook due to the Proposed Action is unlikely to adversely affect food resources in the designated critical habitat of the Southern Resident killer whales." The actual DBO rightly notes that "… the effect of removing available prey resources from individual Southern Residents and the pods they comprise as a result of the Proposed Action is related to several factors working in combination. These include: the magnitude of prey removals; the potential impacts of reduced prey availability; and the overlap between Southern Resident whales and impacted salmon stocks." A rambling discussion follows although it is does present a series of logical arguments that collectively puts the projected level of Chinook salmon declines in perspective. There are a number of assumptions presented but they are adequately acknowledged and various best- and worst-case scenarios are considered. There are a variety of trade-offs related to hatchery closure vs. presumed improvements in available spawning habitat for Chinook. Nonetheless, the Proposed Action is expected to reduce the amount of adult Klamath Chinook entering the ocean. Much of the discussion of killer whale diet relative to Klamath basin comes from work by Hanson et al. (cited as 2010b in the document). It is believed that southern resident killer whales do travel as far south as central

California during winter months. A brief discussion follows regarding the distribution of Klamath chinook in the ocean.

The NMFS DBO states that "the information that would need to be available in order to fully assess the impact of reduced Chinook abundance is mostly lacking or uncertain at best. As a result, several key assumptions must be made in this analysis." The assumptions are reasonable and as noted above, the arguments and story (despite being rambling) do build towards providing a picture of the likely impacts. The DBO is careful to provide context, relying on bioenergetics analyses and information on population sizes. The largest deficiency in scientific information seems to relate to the lack of information on the winter and spring distribution and diet of Southern Residents, and any specific data on Klamath fish distribution during that same time. In the end, the DBO concludes that "As a result, it is not likely that the Proposed Action will adversely affect Southern Resident killer whales in the short term" based largely (and appropriately) on the notion that the action would produce a relatively small reduction in available Chinook prey in the coastal waters of Oregon and California for about 4 years. In the long term, the DBO suggests that the relatively small net reduction in ocean abundance and prey availability due to lost hatchery production that might occur 8 years after dam removal does not seem likely to adversely affect Southern Resident killer whales over the long term. Again, this conclusion seems supported by the available information and logic presented in the document. It is also suggested (i.e., the DBO by NMFS is consistent with the Bureau of Reclamation BA) that "the Proposed Action may affect, but is not likely to adversely affect, ESA-listed Southern Resident killer whales or destroy or adversely modify their designated critical habitat."

The analysis of steller sea lion potential consequences from the action is similar to the killer whales in that the presumed impacts would be derived from changes in salmon abundance in coastal waters. In addition, it is possible that sediment releases could impede foraging or otherwise affect prey availability for sea lions in coastal waters. However, based on normal episodic discharges of California coastal rivers (such as during heavy rain seasons), the DBO states that "the effect of sediment deposit effects on prey for Stellers is likely non-significant and discountable." Similar to the killer whale analyses, the DBO concludes that the relative reduction in Chinook abundance associated with this Proposed Action represent a very small reduction in the total abundance of Chinook off the U.S west coast in the short term after dam removal and sediment release, and in the long term following closure of the Iron Gate Hatchery, 8 years after dam removal. As a result, NMFS DBO presented concurs with the Department of Interior and Bureau of Reclamation that "the Proposed Action may affect, but is not likely to adversely affect, the ESA-listed eastern DPS of steller sea lions or destroy or adversely modify their designated critical habitat by reducing the amount of available prey".

Regarding Climate Change - Research on climate change associated with watersheds in the Pacific northwest has increased dramatically over the past decade. However, much of the work is site-(watershed) specific and there has been comparatively less work in the Klamath Basin than the Fraser or Columbia watersheds. As such, although the DBO does incorporate some information on climate change (including the "latest" from the Klamath), it is certainly not a large body of knowledge on which to draw from. For example, the NMFS used the general life cycle approach (outlined by the Viable Salmonid Population [VSP] report - McElhany et al.

2000) for the DBO because it enabled them to systematically examine the complex linkages between project effects and VSP parameters while also considering and incorporating natural risk factors such as climate change and ocean dynamics. It is unclear how much climate change information actually was used to populate the analysis. Moreover, there is immense population-level variation in how species will respond to climate change so if data used to populate models is not from the same populations, there would be some serious deficiencies with model output (I can't assess this from the information that I have access to). The discussion on page 63 and 64 is probably the most detailed in the report and does provide some insight into expected changes in temperature and flows.

In another example, the DBO states that "climate change…. represents an unclear, yet potentially severe threat to eulachon survival and recovery". Such verbiage is not only fair but recognizes the uncertainty associated with projections given the relatively small information base. Moreover, climate change has typically been studied at the scale of a population or species during one life history phase rather than across multiple species and across multiple spatial scales and life-history stages. There are a variety of feedbacks and biotic interactions (including disease) that are simply not known.

There are examples within the document where modeling of climate change impacts with and without dam removal are provided (e.g., on page 163 – based on the RBM10 model) which is a strength and demonstrates the incorporation of climate change information (to the extent possible) into the DBO.

To summarize, although the DBO includes relevant discussion of climate change, the information available to support such decisions is rarely of sufficient quantity (i.e., burden of proof) or quality (not a problem with science per se, but problems with extrapolation from one system/scale/population to another) to provide certainty regarding the suite of effects that may be encountered with dam removal. That said, it is equally acceptable to state that the same is the case for keeping the dams in place (i.e., uncertainty regarding the outcomes if dam removal were not to proceed). From the perspective of an outsider, climate change must be acknowledged and considered, but in my opinion there is sufficient uncertainty, especially at a watershed or ecosystemic scale, to inform the BO in a meaningful way.

Question 6. Does the biological opinion represent the best scientific information available?

In general, the document is well referenced with a reasonable amount of the material derived from the peer reviewed literature. There is also a fairly significant amount of information derived from technical reports (government, utilities and consultants), some of which could be easily located and other material that would be very difficult to obtain. Nonetheless, it is stated in the DBO that all of the materials used to populate the report were on file and available for viewing at one of the government offices. There was not any information on the tools and

methods used to locate scientific information or a timeline for such searches. In the growing movement towards evidenced-based conservation, systematic reviews (which I suspect is the model that a BO is striving for – see Pullin, A.S. and Stewart, G.B. 2006. Guidelines for systematic review in conservation and environmental management. Conservation Biology 20: 1647-1656.) are the key tool and require transparency and repeatability. Without more information on how information was located and assimilated, it is unclear whether the DBO was assembled in a manner consistent with a systematic review (or even if that is not the target, to give the reader an idea of the efforts involved in finding material).

RECOMMENDATION – Provide a clear and transparent overview as to how information was located and assimilated and if it was done in a systematic and repeatable manner.

The information used is a combination of regional (i.e., Pacific northwest) and watershed-specific (i.e., Klamath). There appear to be no obvious temporal biases in the literature cited (good mix of old and new).

I don't doubt that this is the best information available although additional information (especially with respect to the sediment and thermal thresholds for this stock of coho) would be useful. Moreover, the information on killer whales (diet, distribution) and Klamath Chinook salmon (ocean distribution, importance as a prey item for killer whales) is lacking. There are many inherent challenges in addressing such questions so it is not surprising that there is a paucity of data. As elsewhere in the documents, when the scientific information is lacking or uncertain, there is an appropriate acknowledgement of such limitations as well as discussion of the reasoning for why certain conclusions are reached.

The section on sea lions, although shorter, is poorly referenced relative to other parts of the document so the credibility of the DBO could be improved with greater use of references (although I am not sure that there is more science available).

RECOMMENDATION – Improve the referencing (if possible) for the text on sea lions.

Conclusions and Recommendations

In conclusion, the DBO represents a comprehensive and thorough analysis of what I believe is the best scientific information available. The DBO is cautious in its interpretation in instances where there were shortcomings with available data and was also quite transparent regarding the many assumptions. Nonetheless, the DBO does have some opportunities for improvement and I have noted those in the form of recommendations (listed below). I have provided rather extensive comments on the DBO, but my overall impression is that the document (considering both documents as a single unit) is consistent with the best available science. It is clear that much thoughtful and careful analysis and reasoned interpretation served as the basis for the DBO.

RECOMMENDATION – Integrate the DBO components from the marine mammal analysis into the main DBO.

RECOMMENDATION – Consider reorganizing DBO to improve clarity and to reduce repetition.

RECOMMENDATION – Clarify why there is little if any discussion of green sturgeon.

RECOMMENDATION – Revisit the glyphosate analysis at a higher level to consider on what basis it will be used and if the benefits from its use justify the potential risks.

RECOMMENDATION – Expand (Table 12) or create additional tables that outline the limitations and assumptions in all aspects of the DBO (especially the sections dealing with marine mammals).

RECOMMENDATION – Attempt to reduce speculation, particularly related to disease. There are other parallel documents that discuss (and speculate) upon disease aspects but I don't see them as being essential to the DBO.

RECOMMENDATION – The DBO should emphasize the importance of monitoring and compliance for all BMPs proposed for the action area.

RECOMMENDATION – Provide a concise synthesis for Section 6, stressor 6 (i.e., potential reduction in reading habitat).

RECOMMENDATION – If time permits, conduct empirical studies using various stocks of Klamath coho salmon and various life cycles to identify their sensitivity and thresholds to various concentrations of suspended sediment. The same should also be done for eulachon given that there have been no such studies on that species.

RECOMMENDATION – Consider the system-level benefits (extending beyond fish to the many ecosystem services provided by fish) rather than just the direct benefits on fish.

RECOMMENDATION – Section 7 on cumulative effects should be revised to start with a working definition of "cumulative effects" and it should attempt to better connect to the rest of the document rather than dwelling on climate change.

RECOMMENDATION – Provide a clear and transparent overview as to how information was located and assimilated and if it was done in a systematic and repeatable manner.

RECOMMENDATION – Improve the referencing (if possible) for the text on sea lions.

Appendix 1: Bibliography of materials provided for review

Bartholomew JL and J.S. Foott. 2010. Compilation of Information Relating to Myxozoan Disease Effects to Inform the Klamath Basin Restoration Agreement.

DOI and CDFG (U.S. Department of the Interior and California Department of Fish and Game). 2011. Klamath facilities removal environmental impact statement/environmental impact report. Siskiyou County, California and Klamath County, Oregon. Cooperating Agency Draft. State Clearinghouse # 2010062060. U.S. Department of the Interior, through the U.S. Bureau of Reclamation (Reclamation), and California Department of Fish and Game (CDFG), Sacramento, California.

Dunne T, Ruggerone G, Goodman D, Rose K, Kimmerer W, Ebersole J. 2011. Scientific assessment of two dam removal alternatives on coho salmon and steelhead. Klamath River Expert Panel final report. Prepared with assistance of Atkins.

Hamilton, J., D. Rondorf, M. Hampton, R. Quiñones, J. Simondet, T. Smith. 2011. Synthesis of the Effects to Fish Species of Two Management Scenarios for the Secretarial Determination on Removal of the Lower Four Dams on the Klamath River. Prepared by the Biological Subgroup for the Secretarial Determination Regarding Potential Removal of the Lower Four Dams on the Klamath River. 175p.

Reclamation 2011. Final Biological Assessment and Final Essential Fish Habitat Determination for the Preferred Alternative of the Klamath Facilities Removal EIS/R.

Williams, T. H., E. P. Borkstedt, W. G. Duffy, D. Hillemeier, G. Kautsky, T. E. Lisle, M. McCain, M. Rode, R. G. Szerlong, R. S. Schick, M. N. Goslin, and A. Agrawal. 2006. Historical population structure of coho salmon in the Southern Oregon/Northern California Coasts Evolutionarily Significant Unit. U.S. Dept. Commer. NOAA Tech. memo. NMFS-NWFSC-390. June. 71 p.

Williams, T.H., B. Spence, W. Duffy, D. Hillemeier, G. Kautsky, T. Lisle, M. McCain, T. Nickelson, E. Mora, and T. Pearson. 2008. Framework for assessing viability of threatened coho salmon in the Southern Oregon / Northern California Coasts Evolutionarily Significant Unit. NOAA Technical Memorandum NMFS-SWFSC-432.

Appendix 2: CIE Statement of Work

Statement of Work for Dr. Steven Cooke

External Independent Peer Review by the Center for Independent Experts

Biological Opinion on the Klamath Hydroelectric Settlement Agreement

and accompanying EIS

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: Pursuant to the National Environmental Policy Act (NEPA), the Department of the Interior (Department), through the Bureau of Reclamation (Reclamation), intend to prepare an EIS/EIR. The EIS consider whether to remove four dams on the mainstem Klamath River pursuant to the terms of the Klamath Hydroelectric Settlement Agreement (KHSA), thereby proposing the largest dam removal restoration action in US history. Conflicts over water and other natural resources in the Klamath Basin between conservationists, tribes, farmers, fishermen, and State and Federal agencies have existed for decades. Since 2003, the United States has spent over $500 million in the Klamath Basin for irrigation, fisheries, National Wildlife Refuges, and other resource enhancements and management actions. Consequently, the United States, the States of California and Oregon, the Klamath, Karuk, and Yurok Tribes, Klamath Project Water Users, and other Klamath River Basin stakeholders negotiated the Klamath Basin Restoration Agreement (KBRA) and the KHSA (including the Secretarial Determination) to resolve long-standing disputes between them regarding a broad range of natural resource issues. This is a landmark federal action with a recent litigious history. The project has large potential implications on the economy of California and Oregon, commercial, tribal and recreational fisheries in California and Oregon, and tribal and public trust resources.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have

working knowledge and recent experience in the application of hydrology, river restoration, and pacific salmon life history needs. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review as a desk review, therefore no travel is required.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, and other pertinent information. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than 16 January 2011, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj

Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, David Die, via email to ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

2 December 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
16 December 2011	The report availability date in which the NMFS Project Contact sends the CIE Reviewers the report and background documents
16 December 2011– 16 January 2012	Each reviewer conducts an independent peer review as a desk review
16 January 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
30 January 2012	CIE submits the CIE independent peer review reports to the COTR
6 February 2012	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:

(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,

(2) each CIE report shall address each ToR as specified in **Annex 2**,

(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

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Key Personnel:
NMFS Project Contact:
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Jim.simondet@noaa.gov Phone: 707-825-5171

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review

   Appendix 2: A copy of the CIE Statement of Work

Annex 2: Terms of Reference for the Peer Review

Biological Opinion on the Klamath Hydroelectric Settlement Agreement and accompanying EIS

1. Are the assumptions and the effects conclusions in the biological opinion scientifically reasonable/supportable and logical, especially pertaining to the suspended sediment analysis?

2. Is the herbicide effects analysis in the draft biological opinion scientifically reasonable/supportable and logical?

3. Are the critical habitat and coho salmon effects analysis comprehensive?

4. Are there any missing critical assumptions and effects to fish and habitat (coho, eulachon, green sturgeon) that should be in the draft biological opinion?

5. What sections of the draft biological opinion need to be improved, and any recommendations on how?

6. Does the biological opinion represent the best scientific information available?